United States Patent [19]

Werners et al.

[11] **Patent Number: 4,552,339**

[45] **Date of Patent: Nov. 12, 1985**

[54] **HOISTING DEVICE WITH COMPENSATED TACKLE**

[75] Inventors: **Theo F. H. Werners**, Bilthoven; **Berend W. Drenth**, Drunen, both of Netherlands

[73] Assignee: **Hydraudyne B.V.**, Boxtel, Netherlands

[21] Appl. No.: **617,387**

[22] Filed: **Jun. 5, 1984**

[30] **Foreign Application Priority Data**

Jun. 6, 1983 [NL] Netherlands 8302006

[51] **Int. Cl.**[4] **B66D 1/50**

[52] **U.S. Cl.** **254/277**; 254/335; 254/337; 254/392

[58] **Field of Search** 254/392, 277, 413, 335, 254/337

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Primary Examiner—Stuart S. Levy
Assistant Examiner—Katherine Jaekel
Attorney, Agent, or Firm—John P. Snyder

[57] **ABSTRACT**

A hydraulic or pneumatic cylinder supports a pair of non-circular discs and a circular pulley about which a hoisting cable and a carrying cable are trained. The discs are configured such that a constant force is exerted on a load supported by the hoisting cable independent of the variation in pressure in the cylinder due to displacement of the piston supporting the discs. The carrying cable comprises two runs; one having one end fixed to one of the discs and the other end fixed to the supporting base, and the other having one end fixed to the other disc and the other end fixed to a pulley block supporting the load. The hoisting cable extends from a winch, over the circular pulley, to the pulley block. The arrangement compensates for relative motion between the load and the supporting base.

14 Claims, 6 Drawing Figures

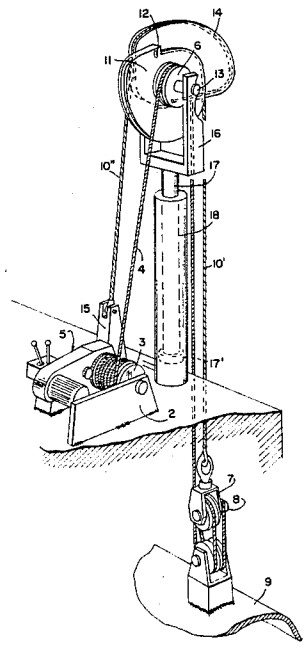
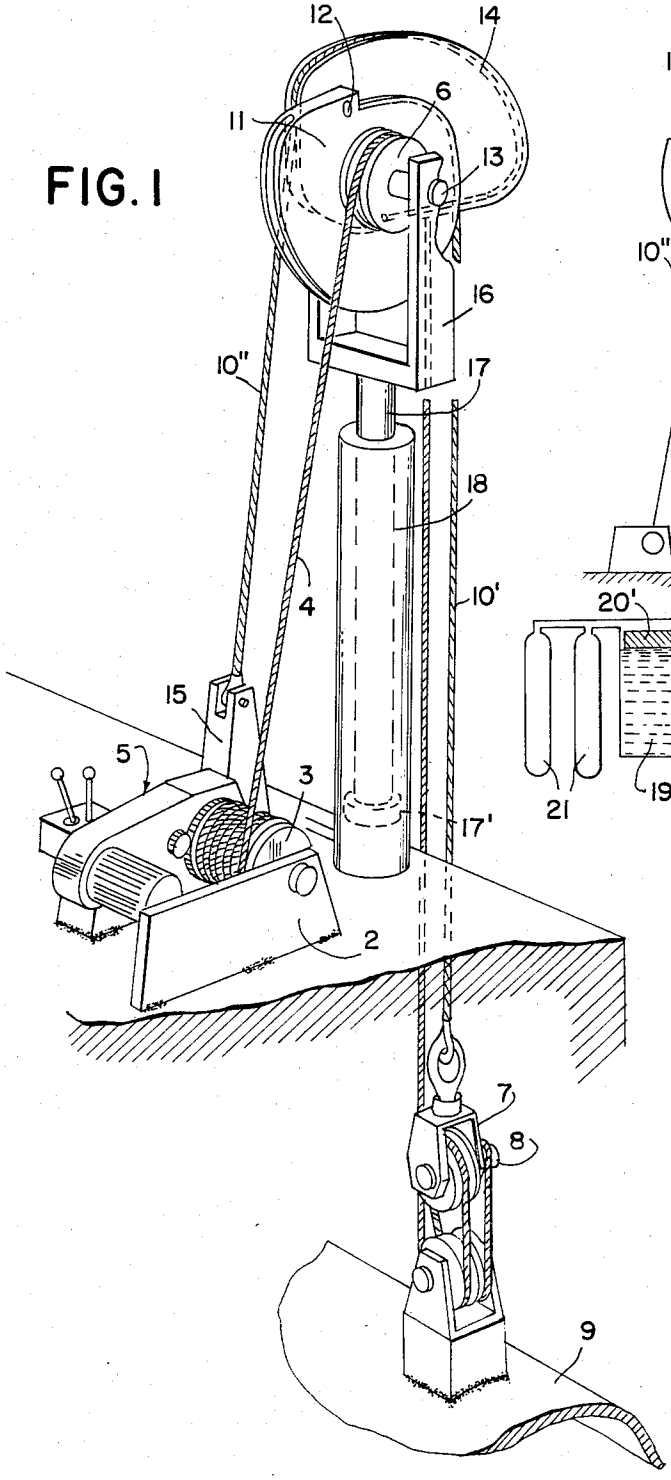


FIG. 1


12
14
11
6
13
16
10"
17
18
4
10'
15
5
3
17'
2
7
8
9

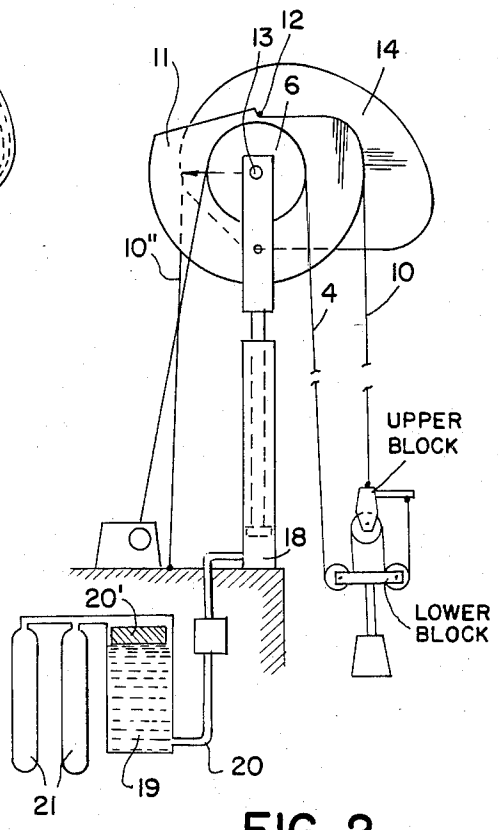

11
13
12
14
6
10"
10
4
UPPER BLOCK
18
20'
LOWER BLOCK
20
19
21

FIG. 2

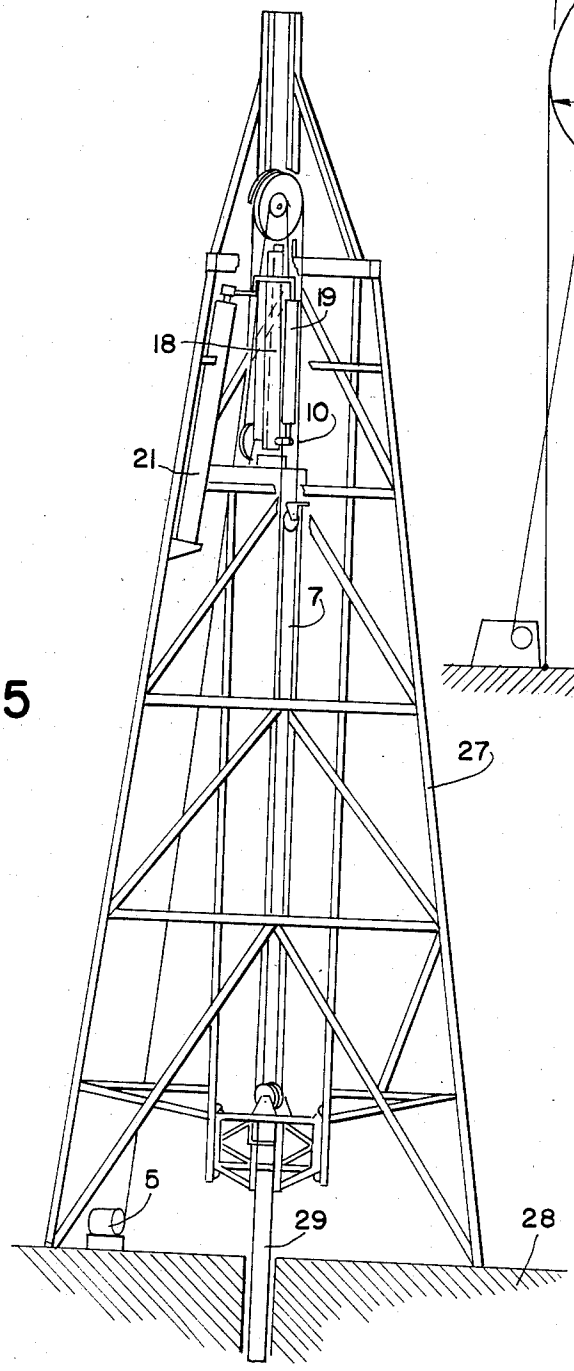


FIG. 5

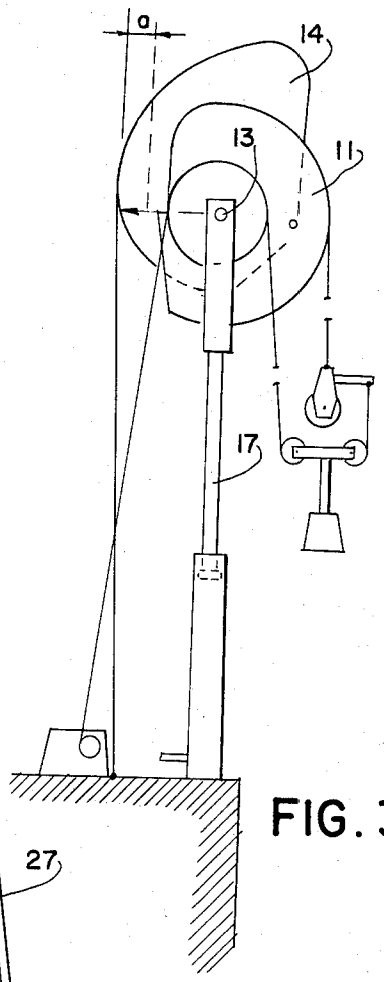
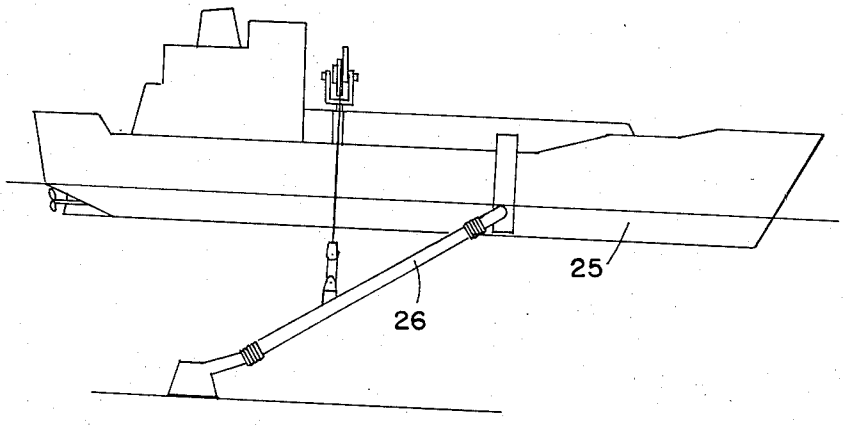


FIG. 3

FIG. 4



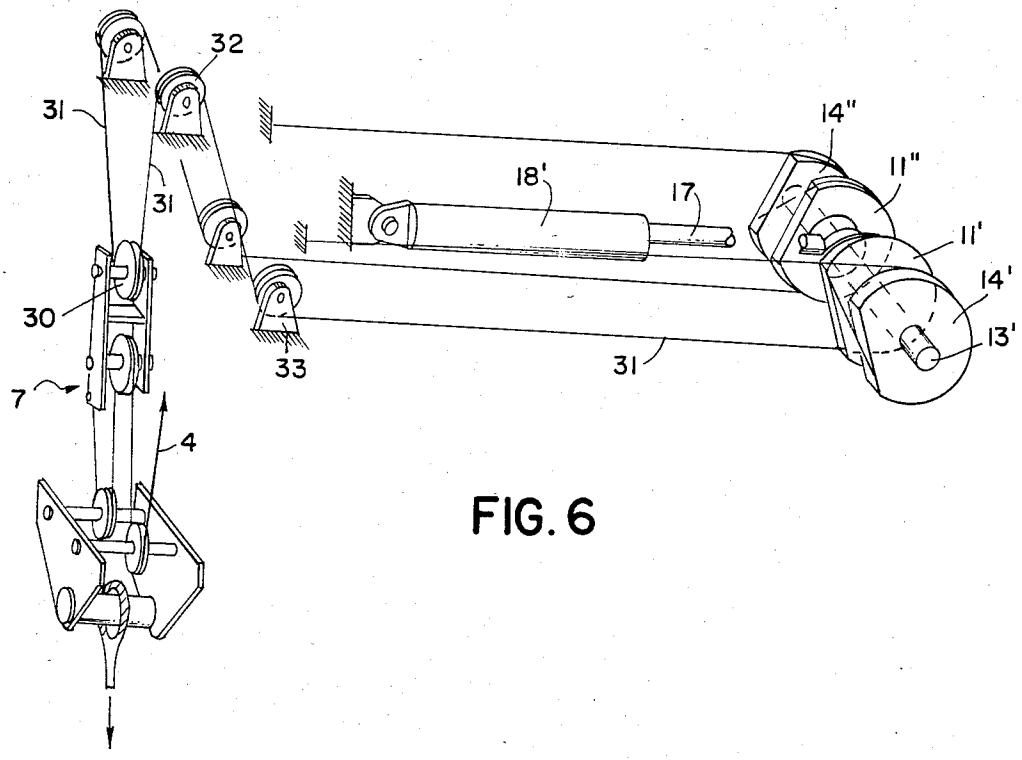


FIG. 6

HOISTING DEVICE WITH COMPENSATED TACKLE

The invention relates to a hoisting device disposed on a freely movable support and mainly comprising one or more hoisting cables adapted to be wound on a winch drum or the like connected with said support and leading to a freely hanging tackle which carries the load.

The invention has for its object to construct the hoisting device so that despite the freely movable support the lower block of the tackle and hence the load remain hanging at the same level.

The device embodying the invention is distinguished in that the tackle is suspended to at least one carrying cable which is directly or indirectly fastened to the support via a disc displaceable by a setting member with respect to the support.

Thanks to the setting member it is now possible to move the tackle with respect to the displaceable support without the need for paying off or hauling the hoisting cable. The setting member takes care of the desired displacement of the disc which thus compensates for the movement of the support. If the load is an element bearing on the sea bottom, a constant ground pressure can thus be maintained.

In a preferred embodiment the setting member is formed by a hydraulic or pneumatic cylinder controlled by a gas buffer.

In order to enable a compensation of the gas pressure fluctuations in the gas buffer, the displaceable disc is designed in the form of a cam or eccentric disc so that with a possibly constant load force automatic compensation occurs as a function of the displacement of the piston rod in the cylinder.

In a further embodiment a reversing disc can, in addition, be journalled for the hoisting cable on the rotary shaft of the displaceable disc so that the hoisting cable need not be hauled or payed out.

The invention will be described more fully with reference to a few embodiments.

The drawing shows in

FIG. **1** a perspective view of a first embodiment of the hoisting device,

FIGS. **2** and **3** schematic side elevations of the hoisting device of FIG. **1** in two different working positions,

FIG. **4** a schematic elevational view of a potential use on a vessel,

FIG. **5** a second potential use in a drilling derrick arranged, for example, on the vessel of FIG. **4**,

FIG. **6** a schematic, perspective view of an alternative embodiment of the hoisting device.

The hoisting device shown in FIG. **1** is arranged on a freely movable support **1**, which may be a vehicle or a vessel.

The hoisting device mainly comprises a winch **2** provided with a winch drum **3**, about which a hoisting cable **4** can be wound. The winch drum can be rotated by any driving gear **5**.

The hoisting cable **4** leads via a reversing disc **6** to a tackle **7**, which consists in this embodiment of a one-disc upper block and a double-disc lower block. The end of the hoisting cable is fastened at **8** to the upper block. The lower block carries a load **9** and may be constructed in any manner with a magnet shoe, hoisting eyelet or the like.

The upper block of the tackle **7** is suspended to a carrying cable **10**, the first run of which leads to a segment disc **11**. This first run **10'** is guided in a circumferential groove and fastened at **12**. The segment disc **11** is fastened to a rotary shaft **13**, on which is journalled the reversing top disc **6** of the hoisting cable **4**.

At the side of the segment disc **11** is arranged a second segment disc **14**, which cannot rotate with respect to the segment disc **11**. The second run of the carrying cable **10** is fastened to the circumference thereof and also guided through a circumferential groove, said second run passing to a fixed point **15** of the support **1**.

The rotary shaft **13** is journalled in a fork-like support **16**, which is arranged at the top side of a piston rod **17**. The piston rod **17** is part of a hydraulic cylinder **18**, which is rigidly secured to the support **1**. The hydraulic cylinder **18** enables the upward and downward movements of the rotary shaft **13** and hence of the top disc **6** and the two segment discs **11** and **14**.

The device described above operates in general as follows. During a downward movement of the support **1**, for example, due to swell in the case of a vessel, the tackle **7** can be held at its level with respect to the sea bottom by energizing the cylinder **18** so that the piston rod **17** moves out of the cylinder **18**. Thus the hoisting cable **4** as well as the carrying cable is moved along the discs so that the segment discs **11** and **14** respectively will turn around the shaft **13**. Also the top disc **6** will turn, but with a circumferential speed differing from that of the segment discs.

When due to pressure fluctuations in the energizing medium of the cylinder **18** the setting force varies in dependence on the displacement of the piston **17'** in the cylinder, the circumferential shape of the segment discs **11** and **13** can be adapted thereto in a manner such that the reactive pressure resulting from the load on the piston rod **17** also varies in relationship to the setting pressure in the cylinder **18** so that compensation is obtained.

The foregoing is set out in detail in FIGS. **2** and **3**. The same parts are designated by the same reference numerals and it is assumed that a gas buffer controlled cylinder **18** is used. The cylinder itself is a hydraulic cylinder fed by a fluid stored in a reservoir **19**, which communicates through the feed duct **20** with the lower side of the cylinder **18**. The reservoir **19** is provided with a separation piston **20**, on the other side of which a pressurized gas is operative. This pressurized gas is stored in bottles **21**. When the piston rod **17** has to move upwards in the cylinder **18**, fluid is pressed from the reservoir **19** below the piston **17'** by means of the gas pressure in the bottles **21**. Obviously with an increasing gas volume the gas pressure decreases and hence also the force expelling the piston rod **17**. This can be compensated for by varying the reactive torque produced by the run **10''** so that a constant force on the lower block of the tackle is ensured.

FIG. **3** illustrates how this is achieved in the embodiment concerned. The segment disc **11** has a circumferential groove, which is in this embodiment concentric with the rotary shaft **13**. The second segment disc **14**, however, is designed so that, when the piston **17'** moves outwards, the distance between the second run **10''** and the rotary shaft **13** varies. This distance variation is indicated by "a" in FIG. **3**. Since the tractive forces in the runs **4** and **10'** will be substantially constant, a reactive torque depending on the position of the piston rod **17** will occur as a result of the variation of the radius with respect to the rotary shaft **13**. Since this reactive torque varies in proportion to the decrease and increase

of the gas pressure in the bottles **21**, a constant force is maintained on the lower block of the tackle.

It will be obvious that any other shape of the two segment discs **11** and **14** is possible, whilst it is also possible to use only one cam disc, that is to say, a combination of the segment discs **11, 14** in which the carrying cable directly passes on and the friction between cable and disc ensures the "connection".

FIGS. **4** and **5** show two possibilities of use, in which a vessel **25** is provided with an implement **26** on the underside thereof. The end of the implement **26** may serve for working the bottom, to scan it and the like and it will be obvious that the end of the implement **26** has to remain at the correct level and the gas pressure has to be constant and low. The implement **26** is suspended to the hoisting appliance described with reference to FIGS. **1** to **3** on the deck of the vessel **25** so that in the case of swell the upward and downward movements of the ship's hull, i.e. the support **1** in FIG. **1**, are compensated for.

In the second example of use a drilling derrick is mounted on, for example, a floating working platform **28** so that also in this case in the event of swell the lower tackle block to which the relatively slender drilling tube **29** is suspended has to remain at its level since otherwise the drilling tube might kink. The weight of the drilling tube can, moreover, be partly taken by the tackle block, since the full weight would be too high for the desired chisel pressure.

Therefore, the upper tackle block is suspended to a carrying cable **10'** of the compensated hoisting device of FIGS. **1** to **3** arranged above in the derrick **27**. It is indifferent to the effect of the compensated hoisting device whether the winch **5** is arranged on the deck of the platform **28** or in the derrick **27**. The gas buffer system **21** or the fluid reservoir **19** arranged in this case in the derrick may also be mounted on the deck.

FIG. **6** shows an alternative embodiment in which the tackle **7** is provided with a guide disc **30**. Around the guide disc is passed a carrying cable **31**, which passes along fixed guide wheels **32, 33** to a segment disc **11'**. The cable is transferred to the adjacent second segment disc **14'**, whilst the free end of the cable is secured to a fixed point of the support. The other part of the cable is passed in a similar manner along segment discs **11''** and **14''** to a second fixed point of the support. The rotary shaft **13'** of the discs is supported by a piston rod **17** of a cylinder **18'**.

The hoisting cable **4** of the tackle **7** is passed directly or indirectly towards a winch disposed on the support. In this embodiment during an upward and downward movement of the support, that is to say, of the compensation device, the lower block of the tackle **7** has to be held at its level by sliding the piston rod **17** in or out. Thus the distance between the discs **11, 14** with respect to the fixed discs **32, 33** is varied so that the upper block of the tackle **7** is moved up and down. The compensation of the hoisting cable **4** in this embodiment has, however, to be taken over by the displacement of the discs **11, 14** so that the lower block of the tackle **7** remains at the same level. Nevertheless the hoisting cable can be compensated through the same or a separate system. Thanks to the double structure of the carrying cable **31** it may be thinner than in the embodiment shown in FIGS. **1** to **3** so that a more flexible system is obtained. Also in this case the segment discs may have any desired shape.

The invention is not limited to the embodiments depicted above. It is, of course, possible to double the embodiment of FIGS. **1** to **3** as well as that of FIG. **6**.

What is claimed is:

1. A hoisting device arranged on a movable support, carrying cable means attached to the support, a tackle suspended from said carrying cable means and including means for attaching a load thereto, at least one hoisting cable connected with said tackle for raising and lowering a load, and motion compensating means for causing said load to remain in a fixed position when said movable support moves relative to said fixed position, said motion compensating means including a control pressure source, and pressure actuated means connected to said control pressure source said pressure actuated means being extendable and retractable in response to variation of said control pressure;

said motion compensating means also including first means and second means which are engaged by said carrying cable means and shifted by said pressure actuated means for simultaneously reeling in and paying out said carrying cable means to impart varying load-related forces on said pressure actuated means.

2. A hoisting device as defined in claim **1** including a pulley shifted by said pressure actuated means and over which said hoisting cable is passed.

3. A hoisting device as defined in claim **1** or **2** wherein said first means is a first disc cooperating with a first portion of said carrying cable means and said second means is a second disc cooperating with a second portion of said carrying cable means, at least one of said discs being eccentrically mounted on said pressure actuated means.

4. A hoisting device as defined in claim **3** wherein said discs are mounted for simultaneous rotation about a common axis with the torque exerted on one disc by said carrying cable means being opposed by the torque exerted on the other disc by said carrying cable means.

5. A hoisting device arranged on a movable support, carrying cable means attached to the support, a tackle having a first portion suspended from said carrying cable means and including a second portion having means for attaching a load thereto, at least one hoisting cable connected with said tackle for raising and lowering said second portion thereof to a desired level, and motion compensating means simultaneously for reeling in and paying out said carrying cable means to maintain the load at said level despite vertical motions of the support, said motion compensating means including a control pressure actuated means which is extendable and retractable in response to variation of said control pressure;

said motion compensating means also including means, engaged by said carrying cable means, for varying forces imparted by said carrying cable means on said control pressure actuated means in response to extension and retraction thereof.

6. A hoisting device as defined in claim **11** wherein the force varying means includes a shaft shifted by said control pressure actuated means, a first disc on said shaft to which a first portion of said carrying cable means is connected, a second disc movable about the axis of said shaft with said first disc to which a second portion of said carrying cable means is connected, said first disc together with said first portion of said carrying cable means operating to urge said shaft rotatably in one direction and said second disc together with said second

portion of said carrying cable means operating to urge said shaft rotatably in an opposite direction.

7. A hoisting device as defined in claim **6** wherein said second disc is eccentrically mounted on said shaft.

8. A hoisting device as defined in claim **6** or **7** including a pulley rotatable on said shaft independently of rotation of said discs, said hoisting cable being passed over said pulley.

9. A hoisting device as defined in claim **5** wherein the force varying means includes a shaft shifted by said pressure actuated means, and including a pulley on said shaft over which said hoisting cable is passed.

10. A hoisting device for suspending a load from a floating hull subjected to vertical wave motion, comprising the combination of:

a tackle assembly comprising an upper block having at least one pulley and a lower block having at least two pulleys and provided with load supporting means;

a winch on said hull and a hoisting cable wound thereon, said hoisting cable being passed over one of said two pulleys of said lower block, over said one pulley of said upper block, over the other of said two pulleys of said lower block and then into connection with said upper block;

carrying cable means for suspending said upper block from said hull; and

motion compensating means for simultaneously reeling in and paying out said carrying cable means to maintain said lower block at a substantially fixed vertical position despite vertical motion imparted to said hull, said motion compensating means comprising pressure actuated means which is expandable and retractable to reel in and pay out said carrying cable means while its actuating pressure varies in response to expansion and contraction, and means responsive to expansion and contraction of said pressure actuated means for varying the resistance to expansion and contraction thereof in consonance with variation of said actuating pressure.

11. A hoisting device as defined in claim **10** wherein the varying means includes a shaft shifted by said control pressure actuated means, a first disc on said shaft over which said carrying cable means is arranged, a second disc movable about the axis of said shaft with said first disc and over which said carrying cable means is arranged, said first disc together with said carrying cable means operating to urge said shaft rotatably in one direction and said second disc together with said carrying cable means operating to urge said shaft rotatably in an opposite direction.

12. A hoisting device as defined in claim **11** wherein said second disc is eccentrically mounted on said shaft.

13. A hoisting device as defined in claim **11** or **12** including a pulley rotatable on said shaft independently of rotation of said discs, said hoisting cable being passed over said pulley.

14. A hoisting device as defined in claim **10** wherein the varying means includes a shaft shifted by said pressure actuated means, and including a pulley on said shaft over which said hoisting cable is passed.

* * * * *